REMARKS

Claim 71 is objected to under 37 CFR 1.75c, as being of improper dependent form for failing to further limit the subject matter of a previous claim.

Claim 71 has been canceled.

Claims 27 – 43 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

(i) claim 27, last line, has been amended to delete "the plurality of components further comprises the undersize particle fraction";

(ii) claim 27 has been amended to delete reference to the term "components".

Claim 27 as amended accordingly is believed to comply with 35 U.S.C. 112, second paragraph.

Claims 43 and 92 have been canceled.

Claim 31 has been amended by deletion of "tungsten disulphide" and molybdenum disulphide".

Claims 27 – 39, 31, 38, 39, 41 – 45, 47, 54, 55, 72, 73 76 – 78, 80, 87, 88, and 90 – 92 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heath (US 3,051,586) in view of Sato et al. (US 4,233,254).

Claim 27 has been further amended to more clearly recite the steps of the method of applicants' invention and to distinguish over the cited art, namely, admixing

a particulate solid lubricant and an inorganic water dispersible binder in a predetermined weight ratio range and water; particulating the mixture and drying the particulated mixture to form dry agglomerates at a temperature below a stabilizing temperature at which the inorganic water dispersible binder is rendered non-dispersible in the water; classifying the dry agglomerates by size into an undersize particle fraction, a desired particle size fraction and an oversize particle fraction; recycling and admixing the undersize and the oversize particle fractions in the mixture for redispersion in the water; and heating the desired particle size fraction to a temperature effective to render the inorganic water dispersible binder in the desired particle size fraction non-dispersible in the water. Applicatns accordingly produce stabilized product agglomerates suitable for high-temperature metallurgical applications while maintaining undersize and oversize agglomerates non-stabilized during processing whereby the undersize and oversize agglomerates can be re-dispersed in water to achieve essentially 100% recovery.

Heath cited as a principal reference discloses a lubricant in the form of a coating or film comprised of organic or inorganic binders and solid lubricants mixed with water and milled to "an extremely finely divided condition...for best results not more than about 3 microns in size" (col. 3, lines 44 – 50) for spraying as a film onto substrate surfaces subjected to mechanical friction. "For most purposes, it is preferable that the binder include, or be entirely composed of, a resinous plastic material,..." (col. 2, lines 33 – 36). Water soluble silicates may be added to improve adhesion characteristics of the film. The film is cured by heat treatment <u>on the substrate</u> and "tightly and continuously adheres to the surface" (col. 2, lines 31, 32).

Heath does not disclose or remotely suggest applicants' method now recited in claim 27 of separating dried agglomerates into undersize, oversize and desired size fractions, re-dispersing the undersize and oversize agglomerates in the water of the

mixture, and heating desired particle size cut to a temperature effective to render the inorganic water dispersible binder non-dispersible in the water.

To reiterate, Heath teaches a near-colloidal slurry of a solid lubricant preferably comprised of an organic resinous plastic material in water for spraying as a film or coating onto a substrate surface for lubricating the surface. The film is cured on the surface to tightly and continuously adhere to the surface. Bentonite is added as a thickening agent and not as a binder.

Heath's alternative teaching of an inorganic binder for higher temperatures in excess of 800°F relates to a ceramic material such as porcelain enamel frits "capable of being fused to a continuous, smooth, uniform thickness film form on the surface to be treated." (col. 2, lines 56 – 62). These ceramic frits are not pertinent to applicants' inorganic water dispersible binders.

In distinction, applicants mix a solid lubricant particles and inorganic water dispersible binder particles with water, particulate and dry particles of the mixture at a temperature below a stabilizing temperature to form dry agglomerates, classify the dry agglomerates into undersize, oversize and product agglomerates, recycle and admix the undersize and oversize agglomerate with the water for redispersion of the binder of the agglomerates in the water of the mixture, whereby the agglomerates break down easily into constituent particles, thereby avoiding waste and avoiding crushing or pulverizing steps and attendant dust production and losses. The product agglomerate are heated to a temperature whereby the product agglomerates are stabilized and rendered non-dispersible in water.

Heath's disclosure of spraying a continuous film or coating onto a surface for lubrication thereof pertains to an unrelated art field.

Sato et al. is cited as a secondary reference to disclose a method to mill solid lubricant and binder mixture by pulverization to form dried particles which are classified into an undersize particle size, a desired particle size, and an oversize particle size fraction. The oversize particle size fraction is crushed to achieve the desired particle size cut. The fines are recycled by adding them back into the process. The mixture is dried at a temperature in the range of 50 to 70°C. Sato et al. use a thermosetting organic resin binder and organic solvents in which the binder dissolves to form a solution of the binder in an organic liquid, such as a resin and/or novalak type phenol resin, or synthetic resins of the thermosetting type in a volatile organic solvent (column 3, lines 13 – 17).

Sato et al. state that granulation is not satisfactory for several reasons. "The conventional methods of granulation are generally classified into wet processes which involve addition of water and dry processes in which the material powder is compressed, compacted, and broken to pieces. None of the processes have, however, proved satisfactory, because of a cumbersome after treatment, large proportion of excessively coarse particles, uneven particle size, and/or low yield of product." (col. 2, lines 31 – 39).

In distinction, applicants' inorganic binders typified by bentonite, fullers earth, montmorillonite and the like hydrous aluminum silicates (page 3, lines 17, 18 of applicants' specification) are hydrophilic and do not dissolve in the water but remain as fine particles in the water. The applicants' oversize agglomerates are easy to redisperse in water without crushing, as is required by Sato et al.

It is Examiner's position that the Sato et al. drying temperatures of from 50 to 70°C are sufficient to render the binder non-dispersible. Sato et al. cure the resin binder at 120° - 300°C (col. 5, line 4). Applicants in distinction rely on their inorganic

binder remaining non-dispersible during drying at temperatures above 70°C and above the Sato et al. curing temperature range of 120° - 300°C to permit redispersion of the recycle undersize and oversize particles in the water of the mixture for recycle and reuse of the particles to obviate crushing of oversize and to achieve almost 100% recovery in any desired size range cut. Applicants' inorganic binder does not stabilize, i.e. become non-dispersible in water, until heated to a temperature above about 850°C.

Only applicants' final product size cut is heated to a stabilizing temperature higher than the drying temperature of the wet mixture to render the particles suitable for thermal spraying (page 5, line 13 to page 6, line 2).

Applicants' method involving the recycling of heat-dried undersize and oversize agglomerates to the water in the starting mixture for redispersion therein permits almost 100% recovery (page 5, lines 4 – 6). For use of the product of applicants' method for thermal spraying, it is very advantageous that the binder is inorganic since organic binders will not stand up to the flame temperatures of above 2000°C of thermal spray processes (page 5, lines 13 – 18) and the agglomerates would disintegrate, causing major problems such as dusting. Heath preferably uses organic binders <u>which create serious problems for flame spraying processes</u>.

It is therefore believed amended claim 27 and claims dependent thereon including claims 29, 38, 39 and 43 are clearly patentable over Heath in view of Sato et al.

Claim 72 as amended relates to a solid lubricant agglomerate comprised a solid lubricant with an inorganic water dispersible binder of a hydrous aluminum silicate produced by the method of the invention. As has discussed above, neither Heath nor Sato et al. discloses applicants' composition comprised of a solid lubricant dispersed in

a continuous matrix of a hydrous aluminum silicate and produced by applicants' method. Claim 72 accordingly is believed to recite a patentable product.

Claim 28 relating to crushing of the oversize particle fraction has been amended to delete reference to crushing of oversize material since applicants redisperse oversize agglomerates and revised to recite that the inorganic binder is a hydrous aluminum silicate that is stabilized at a temperature above about 850°C.

Claims 31, 41, 44, 54 and 55 depend on claims 27 or 44 which are believed patentable over the cited references.

Claim 47 has been cancelled as redundant.

With regard to Sato et al. disclosure of hardening and curing the granules, the specification discloses curing a resol type phenol resin binder at 120° - 300°C. Applicants stabilize an inorganic binder by heating at elevated temperatures above about 850°C.

Claim 73 relating to rounded aggregates indirectly depends on method claims which are believed allowable.

Claims 76 – 78, 80, 87, 88, 90 and 92 relating to recycle of undersize fraction have been withdrawn as redundant.

Claims 32, 33, 36, 48, 49, 52, 81, 82 and 85 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heath (US 3,051,586) in view of Sato (US 4,233,254) as applied to claims 27 and 44 above, and further in view of Dorfman et al. (US 5,506,055).

Heath and Sato et al. have been discussed above. Claims 32, 33, 36, 48, 49, 52, 81, 82 and 85 relate to the presence of hexagonal boron nitride. In that the principal reference Heath in combination with Sato et al. do not disclose or suggest applicants' method, the disclosure of Dorfman et al. for teachings of hexagonal boron nitride is believed not pertinent.

Claims 27 – 31, 35 – 47, 54, 63, 67 – 69, 70, 72 – 80, 87, 88, 89 and 90 – 92 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brown et al. (US 4,039,337) in view of Sato (US 4,233,254).

Brown et al. is cited as a principal reference in view of Sato et al. to disclose solid lubricant in the amount of 5 to 70 wt% and binder in the amount of 10 to 40 wt%, with fillers in an amount of less than 40 vol.% of the solid lubricants. The mixture is milled to a desired size cut.

The Brown et al. reference clearly does not disclose or suggest applicants' method as now claimed in claim 27 and claims 29 – 31, 38, 45 and 46 dependent thereon or on claim 44, as discussed above, in which undersize and oversize agglomerates are recycled and redispersed in water of the mixture for almost 100% recovery and the production of product size agglomerates of a desired close size range without crushing of oversize particles.

Further, with regard to the silicate binder of Brown et al., this binder was discussed in the Response dated October 29, 2007 with reference to the Declaration of William Walkhouse, paragraph 16, copy enclosed, as follows.

"Applicants submit that, a person of ordinary skill in the art, being aware of US '337 (Brown), would not consider using hydrous aluminium silicate as a binder during the making of a solid lubricant agglomerate. This is because of

the pronounced differences between hydrous aluminium silicate and the silicates of US '337, and how these differences affect the manner by which each of them coat components of its respective solid lubricant agglomerate. The mechanism by which hydrous aluminum silicate coats components of the solid lubricant agglomerate (being made by the method as claimed in claim 44), in comparison to the mechanism by which the silicates of US '337 coats components of the solid lubricant agglomerate, is very different. Unlike the water-soluble silicates described in US '337, hydrous aluminium silicate does not actually dissolve into solution as ions. Rather, hydrous aluminium silicate disperses into platelets which are about 300 to 500 microns in diameter, and only 3 to 5 microns thick. The hydrous aluminium platelets develop concentrated areas of cations and anions. Because of this, the individual platelets have a tendency to stick together (like overlapping playing cards) and form a very strong film on the available surface of the agglomerating components as the water is driven off. In contrast, the silicates described in US '337 dissolve in water and coat the particles in US '337 by a wetting action.

Additionally, unlike the silicates described in US '337, the crystallographic structure of the hydrous aluminium silicate binder (of the solid lubricant agglomerate made in accordance with the method as claimed in claim 44) is modified with a post-heat treatment such that the hydrous aluminium silicate binder becomes "stabilized" and cannot be re-dispersed as platelets. In contrast, the silicate binders discussed in US '337 would remain re-dissolvable. Being able to stabilize a binder, such as hydrous aluminium silicate binder (i.e. render the hydrous aluminium silicate non-dispersible), is important for subsequent hydrometallurgical coating operations."

In summary, the silicate binders of Brown et al. remain water soluble and can re-dissolve to form a solution containing individual molecules, as compared to platelets of applicants' hydrons aluminum silicate binders which cannot redisperse after stabilization, as required for applicants' product for use in hydrometallurgical coating. Brown et al. use bentonite as a setting agent, and not as a binder, to produce films and not agglomerates.

Sato et al. disclose pulverizing to a desired particle cut wherein oversize is crushed. Applicants redisperse oversize agglomerates with undersize agglomerates to obviate the extra step of crushing and pulverizing and the resulting production of sharp-edged angular product (page 7, lines 11, 12 and 14 – 16). Applicants particulate agglomerates preferably by spray drying the liquid mixture to produce rounded particles within a desired narrow size range for almost 100% recovery (page 2, lines 23 to page 3, lines 2, page 7, first paragraph, and page 8, first paragraph).

With regard to claim 28, the step of crushing has been deleted and Sato et al. would not be pertinent in this respect.

With regard to claims 41, 42, 44, 47, 54 and 55, applicants do not render the binder non-dispersible at temperatures within the drying range of 50 to 70°C, or even the 120° to 300°C curing temperature range of Sato et al., but have selected hydrous aluminum silicate binders which render the binder non-dispersible at elevated temperatures at or above 850°C, well above drying temperatures of 50 to 70°C or Sato et al. curing temperatures, to permit redispersion of the undersize and oversize agglomerates in the liquid of the mixture.

With regard to claims 40, 56, 71 and 89, these claims relating to sodium silicate have been withdrawn.

With regard to claims 35, 37, 57 – 63 and 67 – 69, these claims depend directly or indirectly on claims 27 and 44 which are believed patentable over the prior art as discussed above. Claims directed to sodium silicate have been withdrawn. Brown et al. do not disclose or suggest hydrous aluminum silicates as has been discussed above and, for the reasons expressed in the Walkhouse Declaration, specific hydrous aluminum silicates of bentonite, fuller's earth and montmorillonite clearly are not obvious variants of the silicates disclosed by Brown et al.

Furthermore, the instant disclosure does not describe these specific silicates as merely preferable for the production of agglomerates for thermal spray processes in which the flame temperatures are above 2000°C. It is stated in lines 18 of page 5 to line 2 of page 6:

"The most suitable inorganic binders are those that have to be stabilized at temperatures higher than the drying temperature of the wet mixture. The low temperature processes for drying the mixtures contemplated in this invention do not stabilize the binder and the particles that fall outside the usable range can be readily reprocessed by re-dispersing the binder and solid lubricant and any filler in the liquid. Only after the right particle size cut is produced is the binder stabilized and rendered non-dispersible and ready for thermal spraying. Stabilized in this context means that the binder can no longer be redispersed in the liquid."

Claims 32 – 34, 36, 48 – 51, 64 – 66, and 81 – 85 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brown et al. (US 4,039,337) in view of Sato (US 4,233,254) as applied to claims 27, 44, 57, and 76 and above, and further in view of Dorfman et al. (US 5,506,055).

Brown et al. in view of Sato et al. have been discussed above and believed patentably distinguished. In that claims 32 – 24, 36, 48 – 51, 64 – 66 and 81 – 85

relating to hexagonal boron nitride depend on claim 27 or 44 which are believed patentable, applicants submit these dependent claims are also patentable.

Concerning obviousness, *Graham v. John Deere* 383 U.S. 1,148 U.S.P.Q. 459(1996) outlines the approach that must be taken when determining whether an invention is obvious. In *Graham*, the Court stated that a patent may not be obtained if the subject matter would have been obvious at the time the invention was made to a person having ordinary skill in the art, but emphasized that nonobviousness must be determined in the light of inquiry, not quality. Approached in this light, §103 permits, when followed realistically, a more practical test of patentability. In accordance with *Graham*, three inquiries must be made in determining whether an invention is obvious.

1) The scope and content of the prior art are to be determined.

2) The difference between the prior art and the claims at issue are to be ascertained.

3) The level of ordinary skill in the pertinent art are resolved.

Against this background, the obviousness or nonobviousness of the subject matter is determined. Secondary considerations, such as commercial success, long felt but unsolved needs, failure of others, etc., can be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.

In conjunction with interpreting 35 U.S.C. §103 under *Graham*, the initial burden is on the Examiner to provide some suggestion of the desirability of doing what the inventor did, i.e. the Examiner must establish a *prima facie* case of obviousness. To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention, or the

Examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references.

To establish a *prima facie* case of obviousness, three basic criteria must be met:

1. There must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference.

2. There must be a reasonable expectation of success.

3. The prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion of the reasonable expectation of success must both be found in the prior art and not based on applicant's disclosure. In *re Vaeck*, 947 F2d 488, 20 U.S.P.Q. 2d 1438 (Fed. Cir., 1991). See MPEP §2143-§2143.03 for decisions pertinent to each of these criteria.

None of these three criteria has been met:

1. There is no suggestion or motivation in any of the references themselves or in knowledge available to one of ordinary skill to modify the references: Heath discloses solid film lubricants cured on rotary bearing or bushing surfaces to reduce mechanical friction, Sato et al. disclose a process for forming a powder of a metal sulfide for self-lubricating parts of oilless bearings; Dorfman et al. relate to the production of abradable coatings having a core particle of boron nitride with subparticles bonded thereto by a polymeric binder; Brown et al. relate to a release and lubricating film for glassware manufacture using a water-soluble binder;

2. No reasonable expectation of success is indicated; in fact the compositions of Heath, Sato et al., Dorfman and Brown et al. would be inoperative in applicants' process; and

3. The references alone or in combination do not motivate, teach or suggest the limitations in either of independent claims 27 or 44, or the remaining claims dependent thereon.

It is believed each of claims 27 – 39, 44 – 46, 48 – 52, 54, 55, 72 and 73 is clearly patentably distinguished over the cited art taken alone or in combination and their favourable consideration and allowance are earnestly solicited.

Respectfully submitted,
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